ECONOMIC VALUATION OF THE RWERU-MUGESERA WETLANDS COMPLEX ECOSYSTEM SERVICES IN RWANDA

Assessment of the Incremental Benefits and Costs of the Business-as-Usual against Maintaining the Baseline

POLICY BRIEF

EXECUTIVE SUMMARY

Wetland ecosystem services can be defined into two broad categories. Those services related to water supply and those services related to water demand. Water supply related ecosystem services include: (1) Maintenance of water flow and supplies e.g., replenishment of water sources, water storage and regulation of flows; (2) Regulation of water quality e.g., wastewater purification and control of sedimentation and siltation; (3) Minimization of water-related hazards and disasters e.g., flood attenuation, and maintenance of water supplies in dry seasons and droughts. The wetland ecosystem services related to demand for and use of water include: maintenance of aquatic and terrestrial resource productivity and the associated products that these yields e.g., fisheries, plants, pasture and forest products. It is these goods and services that have to be considered when talking of the linkages between ecosystems, water and the economy.

The main objective of this study was to carry out a total economic valuation of ecosystem services of the Rweru-Mugesera wetlands complex. In conducting the study, a modified Troy & Wilson method was adopted to develop the research methods which entailed; delineation of study area, typology development, data collection strategy, mapping, and data analysis (estimation of current economic values, scenario analysis for two scenarios i.e., the business-as-usual scenario and maintaining the baseline land use). More than 48 thousand households or about 194 thousand individuals benefit from the wetland's provisioning ecosystem services valued at just under $US 40 million which is worth an average of $US 206 a year per person; value that is equivalent to around one quarter of the $US 780.8 of Rwanda's GDP per capita. The baseline value of regulating services is worth more than $US of 533 million. If the current rates of wetlands change are allowed to continue, then the total economic value will accumulate over $US 14 billion over the 30 years which is equivalent to a net present value of over $US 4billion. However, if the current (baseline) land use spatial extents are maintained then a total of around $US 17 billion shall be accumulated over the 30 years as the economic benefits of the ecosystem services which is equivalent to a net present value of over 4.4 billion.

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1. INTRODUCTION

Wetland ecosystem services can be defined into two broad categories. They can be categorized into those services related to water supply, and those services related to water demand. The wetland ecosystem services related to water supply include: (1) Maintenance of water flow and supplies, for example replenishment of water sources, water storage and regulation of flows; (2) Regulation of water quality, for example wastewater purification and control of sedimentation and siltation; (3) Minimization of water-related hazards and disasters, for example flood attenuation, and maintenance of water supplies in dry seasons and droughts. The wetland ecosystem services related to demand for and use of water include: maintenance of aquatic and terrestrial resource productivity and the associated products that these yields, examples include fisheries, plants, pasture, habitat and nursery for plant and animal species, biodiversity, carbon sequestration and other life support function[1] . Wetlands also provide provisioning, regulating, supporting and cultural ecosystem services, notably related to tourism, recreation, and research[23] . It is these goods and services that have to be considered when talking of the linkages between ecosystems, water and the economy. Wetlands have multidimensional contribution for the ecosystems. While covering only 6% of the Earth's surface, wetlands provide a significant number of ecosystem services and amongst the Earth's most productive ecosystems. However, in contrast to their international importance, many wetlands have been treated as wasteland and drained or otherwise degraded[45] . According to wetland international[6] report, currently about 131 million hectares of the African continent is covered by wetland areas. However, wetland's degradation is one of the major causes for ecosystems deprivation. Rweru-Mugesera wetlands complex covers an area of 30,618.59 ha and is considered as one of the four most important wetlands in Rwanda.

Note that the major challenges to manage wetlands sustainably is that wetlandS users and decision-makers have insufficient understanding of the consequences of alternative management and policy regimes on wetland functioning, ecosystem services and human well-being[7] . The main objective of this study was to carry out a total economic valuation of ecosystem services of Rweru-Mugesera wetlands complex. In conducting the study, a modified Troy & Wilson method was adopted to develop the research methods which entailed; delineation of study area (boundaries & limits of the spatial rear of the wetland), typology development (land use and land cover types), data collection strategy, mapping, and data analysis (estimation of current economic values, scenario analysis for two scenarios i.e., the business as usual and the maintenance of the baseline land use, land cover).

2. THE STUDY FINDINGS

2.1. Land Use Land Cover Types of Rweru-Mugesera Wetlands Complex

The land use land cover for Rweru-Mugesera wetlands complex is majorly comprising of; water bodies (12,956.20ha), cropland (2,607.26ha), Grassland (1,034.92ha), Papyrus and Phragmites -flooded vegetation (6,301.92ha), Mixed vegetation (7,681.66ha), Build areas(17.08ha), Bare ground (19.55ha)

2.2. The ecosystem services and the dependent local community living around the wetland

Fourteen ecosystem services were prioritized by stakeholders and they include; livestock watering grazing, fuelwood, herbal medicine, crop farming, grass harvesting, capture fisheries, papyrus products, flood control, sediment control, waste assimilation, carbon sequestration and storage, and biodiversity. More than 17 sectors are either wholly or partly situated within a three (3) km radius of the wetlands complex. The total population living within the limits of these sectors is close to 240 thousand forming a household population of around 52,173. The dominant ecosystem service in terms of the number of the household population harnessing them is access to water for domestic use at 93% of the local community, followed by crop farming at 47%, harvesting of papyrus and phragmites at 40%, grass harvesting at 38%, fuelwood at 37%, herbal medication at 36%, capture fisheries at 15%, livestock grazing and watering at 5% and irrigation water at 3%.

Table 2: The current (2021) economic values of the wetlands ecosystem services

Ecosystem Service	Wetlands Area Yielding the Service (ha)	Total Economic Value (USD)	Percentage Economic Contribution
Domestic water supply	27,974.70	142,677	0.025%
Water for livestock	27,970.70	13,300	0.002%
Crop farming	2,607.26	7,407,226	1.291%
Livestock grazing	1,034.92	13,300	0.002%
Grass harvesting	1,034.92	10,144,568	1.769%
Capture fisheries	27,974.70	16,144,568	2.815%
Papyrus products	13,983.58	3,884,790	0.677%
Fuelwood	7681.66	1,456,511	0.254%
Herbal medicine	15,018.50	563,460	0.098%
Pollution control	15,018.50	30,682,796	5.350%
Sediment control	15,018.50	2,025,215	0.353%
Flood control	13,983.58	322,691	0.056%
Carbon storage & sequestration	17,662.39	404,866,510	70.591%
Habitat for biodiversity conservation	27,974.70	95,869,297	16.715%
Total	**214938.61**	**573,536,909**	**100.000%**

2.4. Mapping Land use, Land Cover Trends of the Rweru-Mugesera Wetlands Complex

Mapping was conducted using Sentinel 2 imageries from ESRI to map out the various wetlands land uses and land cover and to predict the likely land use land cover patterns in the next 30. The flooded vegetation mainly papyrus and phragmites decreased by 4, 735.77 ha between 2016 and 2020 and would be measuring only 14.80ha if no intervene is made then by the year 2050. The water bodies landcover changed positively by +1,657.2 and is predicted to change to 14,256.83ha by 2050. Similarly, cropland changed positively by 2,374.06ha over the study period and is predicted to cover 5533.29ha by 2050. Mixed vegetation, which mainly cover plants vegetation in non-flooded areas of the wetland changed positively by 7,473.85ha and is predicted to cover an area of 9,562.83ha by 2050.Grassland declined by 6,742.25ha over the study period and is predicted to cover 1034.92ha by 2050. Build areas increased by 15.56ha over the same period and is predicted to cover 17.08ha by 2050, and finally, bare ground landcover declined by 42.64ha and is predicted to cover 19.55ha by 2050.

2.5. The Net Present Values of Business-as-Usual Scenario

The economic performance of two wetlands management options were evaluated over a 30-year period, using a social discount rate of 10% per annum, and Net Present Values as the cost benefit analysis indicator. The first management option is the current wetlands land use practice also called the business as usual or status quo scenario in which the spatial dimensions of the wetlands land use and land cover are assumed to follow trend at the rate of change for the various land use land cover (as was mapped using the ESRI processed Sentinel 2 satellite imageries as discussed in section 2.4) over the next 30 years. The cumulative economic benefits of the ecosystem services over the next 30 years are valued at slightly above US$14 billion while the cumulative costs are valued at slightly above US$ 1.9. billion. If the status quo (business as usual) is maintained, then the Rweru-Mugesera wetlands complex will accumulate a net present value benefit in terms of ecosystem services, worth over $US 3.8. billion by 2050.

2.6. The Net Present Values of Maintaining the Baseline

The second management option is the maintenance of baseline land use land cover. Here we assume that there is no further change on the existing land use and landcover. Under this option, the cumulative total economic benefit of the ecosystem

services over the next 30 years will be slightly over $US 17 billion while the cumulative total costs will be slightly above $US 3.2billion. The net present value of the economic benefit of the maintaining the baseline land use, land cover over the next 30 years is slightly above US$ 4.4. billion.

2.7. The Incremental Benefits of the Business-as-Usual over Maintaining the Baseline

Incremental cost and benefits of allowing the business-as-usual scenario (that is, letting the current patterns of land use continue over the next 30 years as opposed to halting further land use change) was evaluated for the total benefits and costs, and for their net present values for the same 30 years period. Economic values of crop farming would increase by more than $US 86 million over the 30-year period. However, maintaining the baseline land uses spatial extents yields an overall incremental benefits of ecosystem services worth over $US 2.3 billion over 30-year period or net present value of over $US 0.5 billion over the business-as-usual scenario.

RECOMMENDATIONS

- For many of the ecosystem services, especially the regulatory services, there were no easily available, timely and consistent data that could have facilitated use of primary or original use of site-specific data and information, it is therefore recommended that stakeholders consider putting investments in creating the necessary infrastructure for regular data collection and ease of access by the scientific and research community to enable generation of evidence for policy and management guidance.
- To keep track of the flow of the ecosystem services provision, there is need for investments in regular data collection.
- There is need to promote other sources of access of water through investments that help shorten the distance or reduce the time that the local community currently take in drawing water from the wetland complex. This should also apply to access of water for livestock.
- Keeping and grazing the local breeds of cattle in the Rweru-Mugesera wetlands is not economically desirable, there is need to continue with investments that encourage improved breeds of cattle; and cut and carry grass from the wetland be encouraged.
- Investment measures to protect the Rweru-Mugesera wetlands with aim of preventing damage to farms due to flooding should be considered.
- There is need to explore the tapping of the economic potential of climate change mitigation role of the Rweru-Mugesera wetlands complex.
- There is need for regular collection of data on water quality and measures to help improve water quality in the wetlands.
- Develop specific wetland management plans for Rweru-Mugesera and Akagera wetlands complexes and confirm Rweru-Mugesera wetlands complex as a Ramsar site.
- Overall, conservation of the wetland yields overall best economic returns compared to current patterns of use, it is therefore recommended that implementation, enforcement and ensuring compliance to the current policies, laws, regulations, and strategies aimed at conservation and protection of the wetland complex should be enhanced.

POLICY IMPLICATIONS

- More than 93% of the local community depend on the Rweru-Mugesera wetlands complex for domestic water use, therefore conservation of wetland will enable them access water of reasonable quality. However, the amount of time spent in collecting water makes it time consuming and such precious time could be channeled elsewhere in the economy.

- Conservation of the Rweru-Mugesera wetlands complex would enable more than 5% of the local community have access to water for livestock use. Even though the amount of time spent in watering livestock this way is not economically desirable if other sources of opportunities for casual labour were available.

- The Rweru-Mugesera wetlands complex currently offers more than 24 thousand households opportunity to income and nutrition though crop farming inside the wetlands. However, such a carrier function is often in competition with other wetlands uses which when all combined score more than crop farming and other related activities within the wetlands.

- Conservation of the wetland would enable more than 5% of the local community have access to pasture for livestock use. Even though the amount time spent in grazing livestock is not economically desirable if other sources of opportunities for casual labour were available.

- The Rweru-Mugesera wetlands complex currently offers more than 19 thousand households access to grass to feed their livestock.

- The Rweru-Mugesera wetlands complex offers fishery livelihoods and income to more than 7 thousand of the households, and earn them income worth more than $US 16 million per year.

- Conservation of the Rweru-Mugesera wetlands complex would enable more than 20 thousand households in the local community benefit from papyrus and other phragmites with opportunities for mulching, making handicrafts among others that are worth more than $ US 3 million.

- More than 19 thousand households in the local community access fuelwood from the Rweru-Mugesera wetlands complex hence conservation of the resource would provide a source for fuelwood to them. However, the amount time spent in harnessing fuelwood from the wetland makes it economically undesirable.

- The Rweru-Mugesera wetlands complex has a carbon storage potential of over 10 million tons of carbon, and with a sequestration potential of 18 thousand tons annually. This can help the country meet her global obligations towards mitigation of climate change.

- Conserving the Rweru-Mugesera wetlands complex eliminate pollutants that would cost about $US 29 million to clean from the lake reservoirs.

- The Rweru-Mugesera wetlands complex traps sediments amounting to 78.4 tons per ha annually. Conservation of the wetland would therefore save the stakeholders a dredging cost of $US 2 million annually.

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Founded in 1995, ARCOS is a regional conservation organization with the mission to enhance biodiversity conservation and sustainable management of natural resources, in the Albertine Rift region, African Great Lakes region and in Africa mountains ecosystems, through the promotion of collaborative action for nature and people.

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